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KMnO₄溶液改性半焦对烟气中气态Hg⁰的吸附性能研究

王力, 陈继涛, 张华伟, 李敏, 张林林, 刘珊珊

山东科技大学 化学与环境工程学院, 山东 青岛 266590

Adsorption performance of semi-coke modified by KMnO₄ solution for gas-phase Hg⁰ in flue gas

WANG Li, CHEN Ji-tao, ZHANG Hua-wei, LI Min, ZHANG Lin-lin, LIU Shan-shan

College of Chemical and Environmental Engineering, Shandong University of Science and Technology, Qingdao 266590, China

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摘要 在小型固定床实验台上利用半焦及其KMnO₄溶液改性样品进行气态Hg⁰吸附实验。结果表明,在低温时原料半焦对气态Hg⁰具有良好的吸附性能,升温则使其吸附性能迅速降低;经高锰酸钾溶液浸渍处理后,改性半焦在高温140℃时吸附性能明显提高,对浸渍样品在250℃进行热处理可使其吸附性能进一步提高。BET结果表明,原料半焦具有较发达的微孔结构,改性处理使微孔比例下降,孔隙结构发达程度降低;XPS测试表明,改性半焦表面的汞主要以氧化态(Hg²⁺)形式存在,高价锰化合物(KMnO₄、K₂MnO₄、MnO₂)是主要的氧化活性物质。

关键词: 改性半焦 KMnO₄溶液 气态Hg⁰ 烟气脱汞 吸附性能

Abstract: In an attempt to develop a novel and more effective sorbent with low-cost for the removal of gas-phase Hg⁰ from flue gas, the adsorption performance of semi-coke and KMnO₄ solution-modified semi-coke for gas-phase Hg⁰ was investigated with a bench-scale fixed-bed reactor system. The experimental results suggest that the adsorption performance of semi-coke is good at low temperature but weak at higher temperature. The semi-cokes impregnated by KMnO₄ solution have excellent adsorption performance for gas-phase Hg⁰ at 140℃, and can be further enhanced by heating the impregnated samples at 250℃. The BET analysis shows that the semi-coke has rich micro-pores but become poor after modification. The XPS results indicates that the adsorbed mercury on the surface of the modified semi-coke samples mainly exists in oxidation state (Hg²⁺) and these compounds (KMnO₄, K₂MnO₄ and MnO₂) play a key role in the oxidation reaction of gas-phase Hg⁰.

Key words: modified semi-coke KMnO₄ solution gas-phase Hg⁰ mercury removing from flue gas adsorption performance

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通讯作者: 陈继涛, 男, 硕士研究生, Tel: 0532-86057103, E-mail: cjthg2008@126.com. E-mail:

cjthg2008@126.com

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